

Claim Amendments

Please amend claims 1 - 3, 17 - 19 and 27 as follows:

1. (currently amended) A 3-D display device comprising:

a display means that displays left and right images at respective left and right positions on a display panel, the left and right images being partially overlapped on the display panel;

an optical magnifying system having left and right optical viewing systems with respective optical axes that are separate and aligned substantially parallel with one another, the left optical viewing system having an exit pupil and an effective aperture that includes the optical axis of the right optical viewing system, and the right optical viewing system having an exit pupil and an effective aperture that includes the optical axis of the left optical viewing system;

wherein, of the left and right images displayed on the display panel, only the left images are viewable at the left exit pupil and only the right images are viewable at the right exit pupil.

2. (currently amended) ~~The 3-D display device according to Claim 1, wherein:~~ A 3-D display device comprising:

a display means that displays left and right images at respective left and right positions on a display panel, the left and right images being partially overlapped on the display panel; and

an optical magnifying system having left and right optical viewing systems with respective optical axes that are aligned substantially parallel with one another, the left optical viewing system having an exit pupil and an effective aperture that includes the optical axis of the right optical viewing system, and the right optical viewing system having an exit pupil and an effective aperture that includes the optical axis of the left optical viewing system;

wherein:

of the left and right images displayed on the display panel, only the left images are viewable at the left exit pupil and only the right images are viewable at the right exit pupil;

the left and right images have polarizations which are independent of each other;

14           the left and right optical viewing systems of the optical magnifying system have  
15 polarizations which are independent of each other; and

16           the polarization of the right image is the same as the polarization of the right  
17 viewing system, and the polarization of the left image is the same as the polarization of the left  
18 viewing system.

1       3. (currently amended) ~~The 3-D display device according to Claim 1, wherein:~~ A 3-D display  
2 device comprising:

3           a display means that displays left and right images at respective left and right positions on  
4 a display panel, the left and right images being partially overlapped on the display panel; and  
5           an optical magnifying system having left and right optical viewing systems with  
6 respective optical axes that are aligned substantially parallel with one another, the left optical  
7 viewing system having an exit pupil and an effective aperture that includes the optical axis of the  
8 right optical viewing system, and the right optical viewing system having an exit pupil and an  
9 effective aperture that includes the optical axis of the left optical viewing system;

10           wherein:

11           of the left and right images displayed on the display panel, only the left images are  
12 viewable at the left exit pupil and only the right images are viewable at the right exit pupil;

13           the display means displays the left and right images alternately on the display panel in a  
14 time-multiplexed manner; and

15           the displaying of the left and right images is synchronized with a switching operation  
16 between the left and right optical viewing systems so that the right optical viewing system forms  
17 only right images and the left optical viewing system forms only left images.

1       4. (withdrawn) The 3-D display device according to Claim 1, wherein:

2           the display means displays the left and right images using different wavelengths of light  
3 which do not overlap; and

4 the optical magnifying system includes optical elements which operate on a light beam or  
5 do not operate on a light beam depending on the wavelength of the light beam, such that the left  
6 optical viewing system forms left images and does not form right images, and the right optical  
7 viewing system forms right images and does not form left images.

1 5. (original) The 3-D display device according to Claim 1, wherein:

2 the distance between the exit pupils is adjustable by changing the distance between the  
3 left and right viewing systems, which changes the distance between the left and right displayed  
4 images.

1 6. (withdrawn) The 3-D display device according to Claim 1, wherein:

2 one of the distance between the left and right displayed images and the distance between the  
3 left and right viewing systems is separately adjustable.

1 7. (withdrawn) The 3-D display device according to Claim 1, wherein:

2 the left and right images on the display panel are displayed alternately, in a time-  
3 multiplexed manner;

4 the left and right images have polarizations which are independent of each other; and

5 the left optical viewing system passes the polarization of the left image and does not pass  
6 the polarization of the right image, and the right optical viewing system passes the polarization of  
7 the right image and does not pass the polarization of the left image.

1 8. (withdrawn) The 3-D display device according to Claim 1 wherein:

2 the left and right images on the display panel are displayed alternately in a time-division  
3 manner;

4 the left and right optical systems have optical axes which are de-centered with respect to a  
5 centerline of the display panel; and

6 a reconfigurable holographic optical element is provided which is turned on/off in a time-  
7 division manner in synchronism with the display of left and right images.

1 9. (withdrawn) The 3-D display device according to Claim 1 wherein:

2 the display means displays the left and right images using different wavelengths of light  
3 which do not overlap;

4 the left and right optical systems have optical axes which are substantially parallel and a  
5 thick holographic optical element is provided such that the left optical viewing system forms left  
6 images and does not form right images, and the right optical viewing system forms right images  
7 and does not form left images.

1 10. (withdrawn) A 3-D display device comprising:

2 a display means that displays left and right images at respective left and right display  
3 panels, the left and right images having polarizations that are independent of one another;

4 an optical magnifying system having left and right optical viewing systems with  
5 respective optical axes that are aligned substantially parallel with one another, the left optical  
6 viewing system having an exit pupil and an effective aperture that includes the optical axis of the  
7 right optical viewing system, and the right optical viewing system having an exit pupil and an  
8 effective aperture that includes the optical axis of the left optical viewing system;

9 wherein, the left and right optical systems have respective left and right optical axes for  
10 different polarizations of light which are independent of each other such that, of the left and right  
11 images displayed on the display panels, only the left images are viewable at the left exit pupil and  
12 only the right images are viewable at the right exit pupil.

1 11. (original): A 3-D display device comprising:

2 a display means that includes a display panel, said display means displaying left and right  
3 images on the display panel in positions that are shifted to the left and right, respectively; and

4 an optical magnifying system which includes left and right optical viewing systems, the  
5 left and right optical viewing systems having separate optical axes, the left optical viewing  
6 system having an effective aperture that includes the optical axis of the right optical viewing  
7 system, and the right optical viewing system having an effective aperture that includes the optical  
8 axis of the left optical viewing system;

9 wherein

10 the left and right optical viewing systems convey light having different polarizations,  
11 different wavelengths, or different time-division periods such that the left optical viewing system  
12 forms only left images and the right optical viewing system forms only right images,

13 the left image and the left optical viewing system share a first common polarization,  
14 wavelength, or time-division period, and

15 the right image and the right optical viewing system share a different polarization,  
16 wavelength, or time-division period.

1 12. (withdrawn): A viewing device for viewing 3-D images which comprises:

2 a display means which displays left and right images alternately on a display panel;

3 an optical magnifying system which provides images to left and right exit pupils of the  
4 viewing device; and

5 at least two holographic optical elements having different optical axes, each holographic  
6 optical element having an effective aperture that includes the optical axis of the other  
7 holographic optical element.

1 13. (withdrawn): A 3-D display device comprising:

2 a display means which includes display panels, the display means displaying, in a time-  
3 division manner, left and right images having polarized components which are independent of  
4 one another;

5 an optical magnifying system that forms intermediate images of the images displayed by

6 the display means;

7 a birefringent, diffractive optical element located at the position of the intermediate  
8 images; and

9 a viewing optical system having left and right optical paths and an effective aperture that  
10 exceeds the interpupillary distance of a viewer, with the viewing optical system positioned  
11 between the intermediate image and the viewer;

12 wherein

13 the left and right optical paths are switched, at the position of the intermediate images  
14 according to the polarization of the light forming the intermediate images, to respective left and  
15 right exit pupils of the viewing optical system.

1 14. (withdrawn): A 3-D display device comprising:

2 a display means which includes display panels, the display means displaying, in a time-  
3 division manner, left and right images having polarized components which are independent of  
4 one another;

5 an optical magnifying system which forms intermediate images of the images displayed  
6 by the display means;

7 a reconfigurable holographic optical element, positioned at the location of the  
8 intermediate images, the polarization of the holographic optical element being switchable in a  
9 time-division manner so as to be synchronized with the display of left and right images; and

10 a viewing system, positioned between the intermediate images and a viewer, and having  
11 an effective aperture that exceeds the interpupillary distance of the viewer;

12 wherein

13 left and right images are formed at respective left and right exit pupils, said left and right  
14 images being images of the intermediate images according to the switching of the reconfigurable  
15 holographic optical element in a time-division manner.

1 15. (withdrawn): A 3-D display device comprising:

2 a display means that includes display panels, said display means displaying left and right  
3 images on the display panels;

4 an optical system positioned in each light path following the displayed left and right  
5 images which forms collimated left and right light beams;

6 left and right apertures, respectively, positioned in the collimated left and right light  
7 beams;

8 an imaging lens for focusing the collimated left and right light beams onto the same  
9 position; and

10 an optical magnifying system that forms intermediate images of the displayed left and  
11 right images;

12 wherein

13 the light at the intermediate images is divided into left and right light paths by a  
14 difference in the positions of the entrance pupils of the light forming the intermediate images;  
15 and

16 a viewing system that forms images of the intermediate images at respective left and right  
17 exit pupils, the viewing system having an effective aperture that exceeds the distance between the  
18 left and right exit pupils.

1 16. (withdrawn): The 3-D display device according to Claim 15 wherein

2 the distance between the left and right exit pupils may be changed by changing the  
3 distance between said collimated left and right beams so as to adjust the distance between the left  
4 and right exit pupils to the interpupillary distance of a viewer.

1 17. (currently amended): A 3-D display device comprising:

2 a display which includes a display panel on which left and right images are displayed at  
3 respective left and right positions, the left and right images being partially overlapped on the

4 display panel;

5 an optical magnifying system having left and right optical viewing systems with  
6 respective optical axes that are separate and aligned substantially parallel with one another, the  
7 left optical viewing system having an exit pupil and an effective aperture that includes the optical  
8 axis of the right optical viewing system, and the right optical viewing system having an exit pupil  
9 and an effective aperture that includes the optical axis of the left optical viewing system;

10 wherein, of the left and right images displayed on the display panel, only the left images  
11 are viewable at the left exit pupil and only the right images are viewable at the right exit pupil.

1 18. (currently amended): ~~The 3-D display device according to Claim 17, wherein:~~

2 A 3-D display device comprising:

3 a display which includes a display panel on which left and right images are displayed at  
4 respective left and right positions on a display panel, the left and right images being partially  
5 overlapped on the display panel;

6 an optical magnifying system having left and right optical viewing systems with  
7 respective optical axes that are separate and aligned substantially parallel with one another, the  
8 left optical viewing system having an exit pupil and an effective aperture that includes the optical  
9 axis of the right optical viewing system, and the right optical viewing system having an exit pupil  
10 and an effective aperture that includes the optical axis of the left optical viewing system;

11 wherein,

12 of the left and right images displayed on the display panel, only the left images are  
13 viewable at the left exit pupil and only the right images are viewable at the right exit pupil;

14 the left and right images have polarizations which are independent of each other;

15 the left and right optical viewing systems of the optical magnifying system have  
16 polarizations which are independent of each other; and

17 the polarization of the right image is the same as the polarization of the right viewing  
18 system, and the polarization of the left image is the same as the polarization of the left viewing



19 system.

1 19. (currently amended): ~~The 3-D display device according to Claim 17, wherein:~~

2 A 3-D display device comprising:

3 a display which includes a display panel on which left and right images are displayed at  
4 respective left and right positions on a display panel, the left and right images being partially  
5 overlapped on the display panel;

6 an optical magnifying system having left and right optical viewing systems with  
7 respective optical axes that are separate and aligned substantially parallel with one another, the  
8 left optical viewing system having an exit pupil and an effective aperture that includes the optical  
9 axis of the right optical viewing system, and the right optical viewing system having an exit pupil  
10 and an effective aperture that includes the optical axis of the left optical viewing system;

11 wherein,

12 of the left and right images displayed on the display panel, only the left images are  
13 viewable at the left exit pupil and only the right images are viewable at the right exit pupil;

14 the display displays the left and right images alternately on the display panel in a time-  
15 multiplexed manner; and

16 the displaying of the left and right images is synchronized with a switching operation  
17 between the left and right optical viewing systems so that the right optical viewing system forms  
18 only right images and the left optical viewing system forms only left images.

1 20. (withdrawn): The 3-D display device according to Claim 17, wherein:

2 the display displays the left and right images using different wavelengths of light which  
3 do not overlap; and

4 the optical magnifying system includes optical elements which operate on a light beam or  
5 do not operate on a light beam depending on the wavelength of the light beam, such that the left  
6 optical viewing system forms left images and does not form right images, and the right optical

viewing system forms right images and does not form left images.

21. (previously presented): The 3-D display device according to Claim 17, wherein:

the distance between the exit pupils is adjustable by changing the distance between the left and right viewing systems, which changes the distance between the left and right displayed images.

22. (withdrawn): The 3-D display device according to Claim 17, wherein:

one of the distance between the left and right displayed images and the distance between the left and right viewing systems is separately adjustable.

23. (withdrawn): The 3-D display device according to Claim 17, wherein:

the left and right images on the display panel are displayed alternately, in a time-multiplexed manner;

the left and right images have polarizations which are independent of each other; and the left optical viewing system passes the polarization of the left image and does not pass the polarization of the right image, and the right optical viewing system passes the polarization of the right image and does not pass the polarization of the left image.

24. (withdrawn): The 3-D display device according to Claim 17 wherein:

the left and right images on the display panel are displayed alternately in a time-division manner;

the left and right optical systems have optical axes which are de-centered with respect to a centerline of the display panel; and

a reconfigurable holographic optical element is provided which is turned on/off in a time-division manner in synchronism with the display of left and right images.

1 25. (withdrawn): The 3-D display device according to Claim 17 wherein:

2 the display displays the left and right images using different wavelengths of light which  
3 do not overlap;

4 the left and right optical systems have optical axes which are substantially parallel and a  
5 thick holographic optical element is provided such that the left optical viewing system forms left  
6 images and does not form right images, and the right optical viewing system forms right images  
7 and does not form left images.

1 26. (withdrawn): A 3-D display device comprising:

2 a display which includes left and right display panels and that displays left and right  
3 images at the respective left and right display panels, the left and right images having  
4 polarizations that are independent of one another;

5 an optical magnifying system having left and right optical viewing systems with  
6 respective optical axes that are aligned substantially parallel with one another, the left optical  
7 viewing system having an exit pupil and an effective aperture that includes the optical axis of the  
8 right optical viewing system, and the right optical viewing system having an exit pupil and an  
9 effective aperture that includes the optical axis of the left optical viewing system;

10 wherein, the left and right optical systems have respective left and right optical axes for  
11 different polarizations of light which are independent of each other such that, of the left and right  
12 images displayed on the display panels, only the left images are viewable at the left exit pupil and  
13 only the right images are viewable at the right exit pupil.

1 27. (previously presented): A 3-D display device comprising:

2 a display that includes a display panel, said display displaying left and right images on the  
3 display panel in positions that are shifted to the left and right, respectively; and

4 an optical magnifying system which includes left and right optical viewing systems, the  
5 left and right optical viewing systems having separate optical axes, the left optical viewing

6 system having an effective aperture that includes the optical axis of the right optical viewing  
7 system, and the right optical viewing system having an effective aperture that includes the optical  
8 axis of the left optical viewing system;

9 wherein

10 the left and right optical viewing systems convey light having different polarizations,  
11 different wavelengths, or different time-division periods such that the left optical viewing system  
12 forms only left images and the right optical viewing system forms only right images,

13 the left image and the left optical viewing system share a first common polarization,  
14 wavelength, or time-division period, and

15 the right image and the right optical viewing system share a different polarization,  
16 wavelength, or time-division period.

1 28. (withdrawn): A viewing device for viewing 3-D images which comprises:

2 a display which includes a display panel on which left and right images are alternately  
3 displayed;

4 an optical magnifying system which provides images to left and right exit pupils of the  
5 viewing device; and

6 at least two holographic optical elements having different optical axes, each holographic  
7 optical element having an effective aperture that includes the optical axis of the other  
8 holographic optical element.

1 29. (withdrawn): A 3-D display device comprising:

2 a display which includes display panels on which are displayed, in a time-division  
3 manner, left and right images having polarized components which are independent of one  
4 another;

5 an optical magnifying system that forms intermediate images of the images displayed by  
6 the display;

7 a birefringent, diffractive optical element located at the position of the intermediate  
8 images; and

9 a viewing optical system having left and right optical paths and an effective aperture that  
10 exceeds the interpupillary distance of a viewer, with the viewing optical system positioned  
11 between the intermediate image and the viewer;

12 wherein

13 the left and right optical paths are switched, at the position of the intermediate images  
14 according to the polarization of the light forming the intermediate images, to respective left and  
15 right exit pupils of the viewing optical system.

1 30. (withdrawn): A 3-D display device comprising:

2 a display which includes display panels on which are displayed, in a time-division  
3 manner, left and right images having polarized components which are independent of one  
4 another;

5 an optical magnifying system which forms intermediate images of the images displayed  
6 by the display;

7 a reconfigurable holographic optical element, positioned at the location of the  
8 intermediate images, the polarization of the holographic optical element being switchable in a  
9 time-division manner so as to be synchronized with the display of left and right images; and

10 a viewing system, positioned between the intermediate images and a viewer, and having  
11 an effective aperture that exceeds the interpupillary distance of the viewer;

12 wherein

13 left and right images are formed at respective left and right exit pupils, said left and right  
14 images being images of the intermediate images according to the switching of the reconfigurable  
15 holographic optical element in a time-division manner.

1 31. (withdrawn): A 3-D display device comprising:

2 a display that includes display panels on which are displayed left and right images;  
3 an optical system positioned in each light path following the displayed left and right  
4 images which forms collimated left and right light beams;  
5 left and right apertures, respectively, positioned in the collimated left and right light  
6 beams;  
7 an imaging lens for focusing the collimated left and right light beams onto the same  
8 position; and  
9 an optical magnifying system that forms intermediate images of the displayed left and  
10 right images;  
11 wherein  
12 the light at the intermediate images is divided into left and right light paths by a  
13 difference in the positions of the entrance pupils of the light forming the intermediate images;  
14 and  
15 a viewing system that forms images of the intermediate images at respective left and right  
16 exit pupils, the viewing system having an effective aperture that exceeds the distance between the  
17 left and right exit pupils.

1 32. (withdrawn): The 3-D display device according to Claim 31 wherein  
2 the distance between the left and right exit pupils may be changed by changing the  
3 distance between said collimated left and right beams so as to adjust the distance between the left  
4 and right exit pupils to the interpupillary distance of a viewer.